Robotic In-Situ Surface Exploration System (RISES)

Completed Technology Project (2015 - 2017)

Project Introduction

NASA's Asteroid Redirect Mission (ARM) is a pivotal and daring approach that will mature multiple technologies for future deep space exploration. ARM seeks to capture a near-Earth asteroid and return it to a stable lunar orbit where astronauts can explore and bring back samples from the asset. One process being studied to capture an asteroid, is to have the robotic craft land on the surface of a larger parent asteroid and use dexterous robotic manipulation to pickup a boulder from the surface and secure it for the transportation to lunar orbit. The Robotic In-Situ Surface Exploration System (RISES) proposed in this work aims to mature mining sensor technologies such as sonic wave velocity sensors and Schmidt Hammer technology to provide in-situ analysis of the asteroid material which, in turn, can aid the robotic manipulation/pickup procedure and an ISRU system by understanding the material strength and composition, respectively. The sensing capabilities of sonic wave velocity and Schmidt Hammer sensors on a scale relative to ARM (1-10m boulder/asteroid diameter) will be studied and the requirements to advance such technology in support of ARM and ISRU will be determined. The integration of the matured sensor system for ARM and ISRU will be integrated and tested on advanced robotic manipulator platforms which will utilize the robot kinematics for accurate position measurements between the sensor transducer and receiver. The testing will advance the TRL level of the RISES system and show the application to future NASA missions and objectives.

Anticipated Benefits

The Robotic In-Situ Surface Exploration System (RISES) in this work aims to mature mining sensor technologies such as sonic wave velocity sensors and Schmidt Hammer technology to provide in-situ analysis of the asteroid material which, in turn, can aid the robotic manipulation/pickup procedure and an ISRU system by understanding the material strength and composition, respectively.

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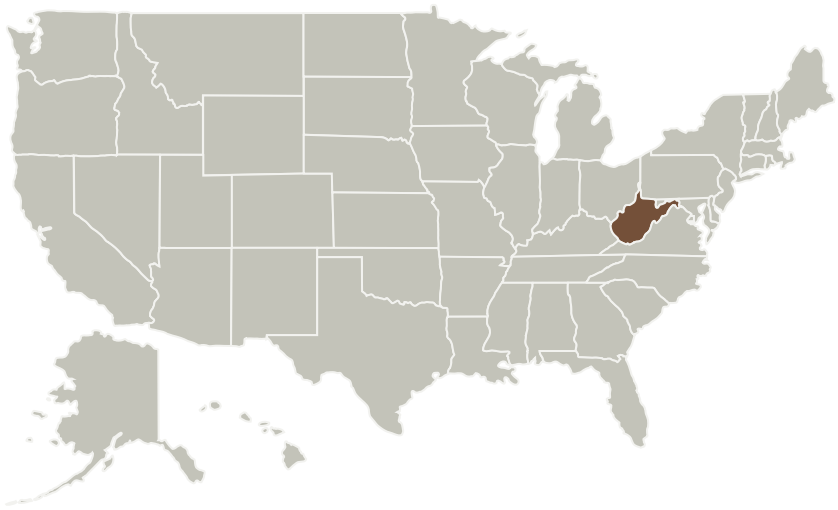
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
West Virginia University	Lead Organization	Academia	Morgantown, West Virginia

Primary U.S. Work Locations
West Virginia

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

West Virginia University

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

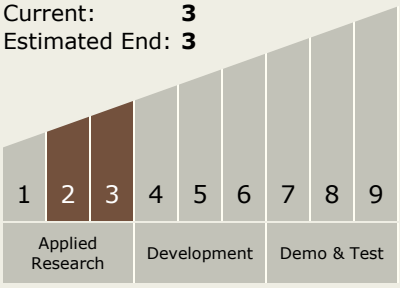
Hung D Nguyen

Principal Investigator:

Thomas W Evans

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destinations

The Moon, Others Inside the Solar System